Customer No.: 31561
Docket No.:12009-US-PA
Application No.: 10/605,782

REMARKS

Present Status of the Application

The disclosure is objected to because an incomplete sentence is found in paragraph [0004], lines 1-4. Claims 1-16 are rejected under 35 U.S.C. 103(a), as being unpatentable over Maiti et al. (US Patent 5,885,870, hereinafter Maiti) in view of Ohmi et al. (US Patent 6,551,948, hereinafter Ohmi). Applicants have amended paragraph [0004] and canceled claims 2 and 8. Reconsideration and withdrawal of the Examiner's rejection is respectfully requested.

Discussion of Office Action Rejections

The Office Action rejected claims 1 -16 under 35 U.S.C. 103(a). as being unpatentable over Maiti et al. (US Patent 5,885,870) in view of Ohmi et al. (US Patent 6,551,948).

MPEP 2142 provides "The examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness." "To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

Applicants respectfully assert that Maiti et al. in view of Ohmi et al. is legally deficient for the purpose of rendering claims 1, 3-7 and 9-16 unpatentable for at least the reason that not

every element of the claim was taught or suggested by cited references such that the invention as a whole would have been obvious to one of ordinary skill in the art.

The present invention specifically teaches "performing an in-situ steam generation (ISSG) process to form a silicon oxide layer as a tunnel oxide layer on a semiconductor substrate" as taught in claims 1, 7 and 13.

In Office Action page 4, line 19 to page 5, line 2, the examiner states " It would have also been obvious to one of ordinary skill in the art to have formed the silicon oxide comprising performing an in-situ steam generation (ISSG) process.....". However, Maiti and Ohmi fail to teach that "performing an in-situ steam generation (ISSG) process to form a silicon oxide layer as a tunnel oxide layer on a semiconductor substrate" as taught in claims 1, 7 and 13. In Maiti and Ohmi, it only describes the plasma oxidation method on the substrate. However, the plasma oxidation process is not equivalent to the in-situ steam generation (ISSG) process, and the claimed invention using ISSG process has an unexpected result.

Table 1 shows a comparison for plasma oxidation and ISSG process.

Table 1

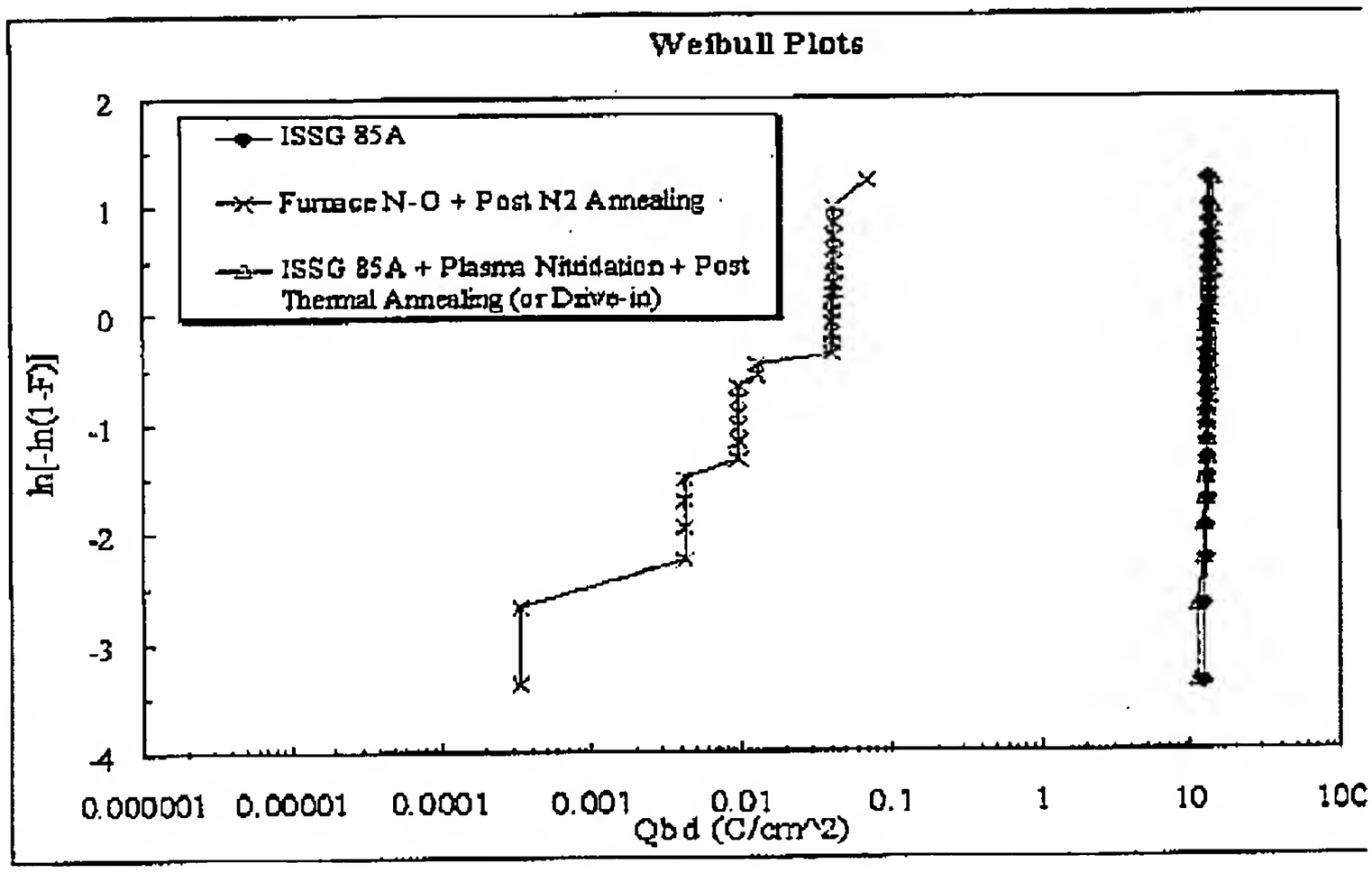
	Ohmi	ISSG process
1. microwave exitation for plasma generation (i.e. electric field applied in the chamber)	Yes	No
2. low-pressure to dissolve ($H_2 + O_2$) into O* and OH*	No	Yes
3. Electric field to accelerate plasma (charged, with electric polarity) to Si surface for oxidation reaction	Yes	No
4.Oxidation temperature	low (<55°C)	high (>800°C)(to increase the reaction activity)

According to table 1, we can realize the operating mechanism, species and temperature of the plasma oxidation and ISSG process are different. A genus does not always anticipate a claim to a species within the genus. However, when the species is clearly named, the species claim is anticipated no matter how many other species are additionally named. Ex parte A, 17 USPQ2d 1716 (Bd. Pat. App. & Inter. 1990)

According to table 1, those skilled in the ordinary art will not think the plasma oxidation method being equivalent to in-situ steam generation (ISSG) process. Hence, Maiti and Ohmi alone or in combination, does not contemplate Element "performing an in-situ steam generation (ISSG) process to form a silicon oxide layer as a tunnel oxide layer on a semiconductor substrate" as taught in claims 1, 7 and 13.

A.) The inventor provides the experiments for comparing charge-to-breakdown (Qbd) of the claimed invention and Maiti et al. with the result shown in Fig. 1. The line (Δ) indicates a result of one embodiement in the claimed invention "ISSG 85A + plasma nitridation + thermal drive-in". The line (×) indicates the result of the embodiment similar to Maiti et al. "thermal oxidation and + Furnace nitridation + post thermal annealing (or drive-in)". Figure 1 shows that the charge-to-breakdown (Qbd) of the process "Furnace N-O + Post N_2 Annealing" is very poor (<0.1 C/cm^2) and processes of "ISSG 85A" (pure oxide) and "ISSG 85A + Plasma Nitridation + Post Thermal Annealing (or Drive-in)" (one embodiment in claimed invention) perform comparable Qbd (>10 C/cm^2). The claimed invention has an unexpected result better than Maiti.

Fig. 1 charge-to-breakdown test



B.) Fig. 2 demonstrates the SILC measurement of claimed invention and Ohmi et al.. The result shows that the level of "SILC" is larger than 1E-4 A which means the oxide has broken down by the -FN stress. Therefore the measured "SILC" is actually the high direct tunneling current.

Ohmi only disclose the plasma oxidation process and plasma nitridation process are performed on the substrate. There is no description of thermal anneal process. The condition is similar to "ISSG 85A + plasma nitridation" labeled in Fig. 2. In our experiment result we also

find that if lacking of the post thermal annealing, the SILC performance (using the methodology in Fig. 2) will be degraded and even worse than that of ISSG 85A pure oxide. The result is worse than the embodiment shown in claimed invention.

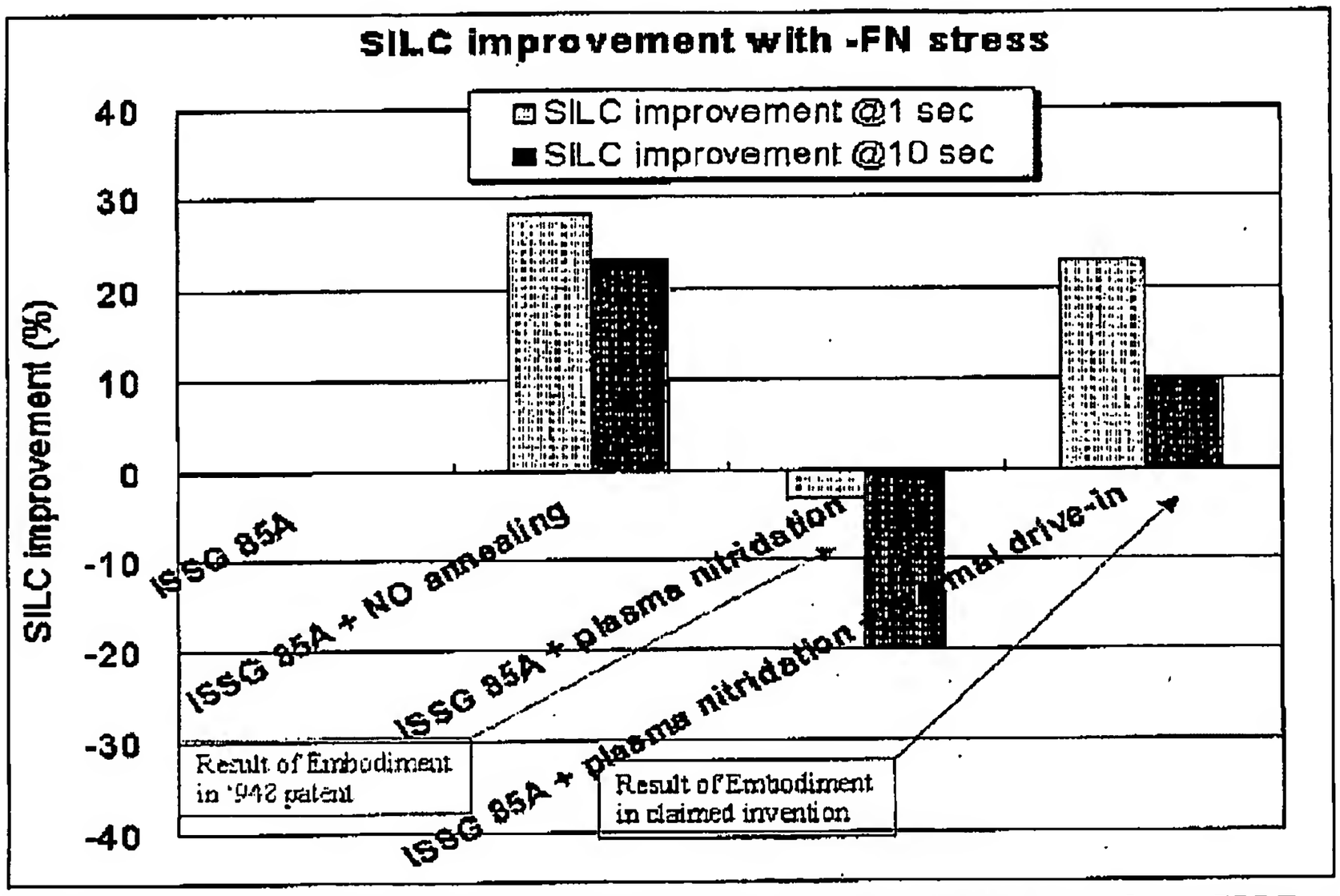


Fig. 2 SILC performance degradation by adding plasma nitridation only on ISSG oxide.

According to the above explanation on paragraph A) and B), Maiti or Ohmi alone does not provide a good performance. There is no reasonable expectation of success . The references do not contain any suggestion (directly expressed or implied) that they can be combined, or that

they can be combined in a manner suggested. There is no motivation to combine prior art references to solve the problem stated in the claimed invention.

Further, Maiti in view of Ohmi does not contemplate Element "performing an in-situ steam generation (ISSG) process to form a silicon oxide layer as a tunnel oxide layer on a semiconductor substrate" in this invention. The examiner fails to establish the evidence for prima facie conclusion of obviousness. Applicants therefore respectfully submit that Maiti in view of does not render the present invention of claims 1, 7 and 13 unpatentable. Applicants respectfully request withdrawing the rejection against claims 1, 7 and 13 from Office Action.

Dependent claims 3-6 and 9-12 and 14-16 are submitted to be patentably distinguishable over the prior art of record for at least the same reasons as independent claim 1 from which these claims respectively depend, as well as for the additional features that these claims recite.

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CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1, 3-7 and 9-16 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

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